# PHYTOTOXICOLOGY ASSESSMENT SURVEY

# INVESTIGATIONS IN THE VICINITY OF TRICIL LTD., CORUNNA, 1987

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## 1 INTRODUCTION

The Phytotoxicology Section has been conducting an annual assessment survey in the vicinity of Tricil Ltd., Corunna every year since 1977, except for 1980 (D.S. Harper 1977, 1978, 1981, 1985, R.D. Jones 1982, 1983, 1984, 1985, 1985, 1987). The original survey consisted of 30 sampling stations within 10 km of the company. The number of stations has changed from year to year. Since 1984 the survey has consisted of the same 12 stations. In the original survey silver maple foliage and soil samples were collected. Soil has not been collected since 1978. Grass samples were collected for a four year period but are no longer collected. See the Appendix A for a list of the type of samples collected and the number of stations sampled in each year.

The Tricil plant at Corunna is an industrial waste disposal operation, that includes landfill and incineration. The surveys that have been carried out since 1977 have been oriented towards determining if there was an accumulation of inorganic contaminants in vegetation resulting from the incineration process. Up to 1984 no evidence of inorganic contamination of vegetation by the company had been found in any of the surveys by the Phytotoxicology Section. A pattern of slightly elevated concentrations of chromium, iron, sodium and zinc was first observed in the 1986 data and upon closer examination was also found in the 1985 data.

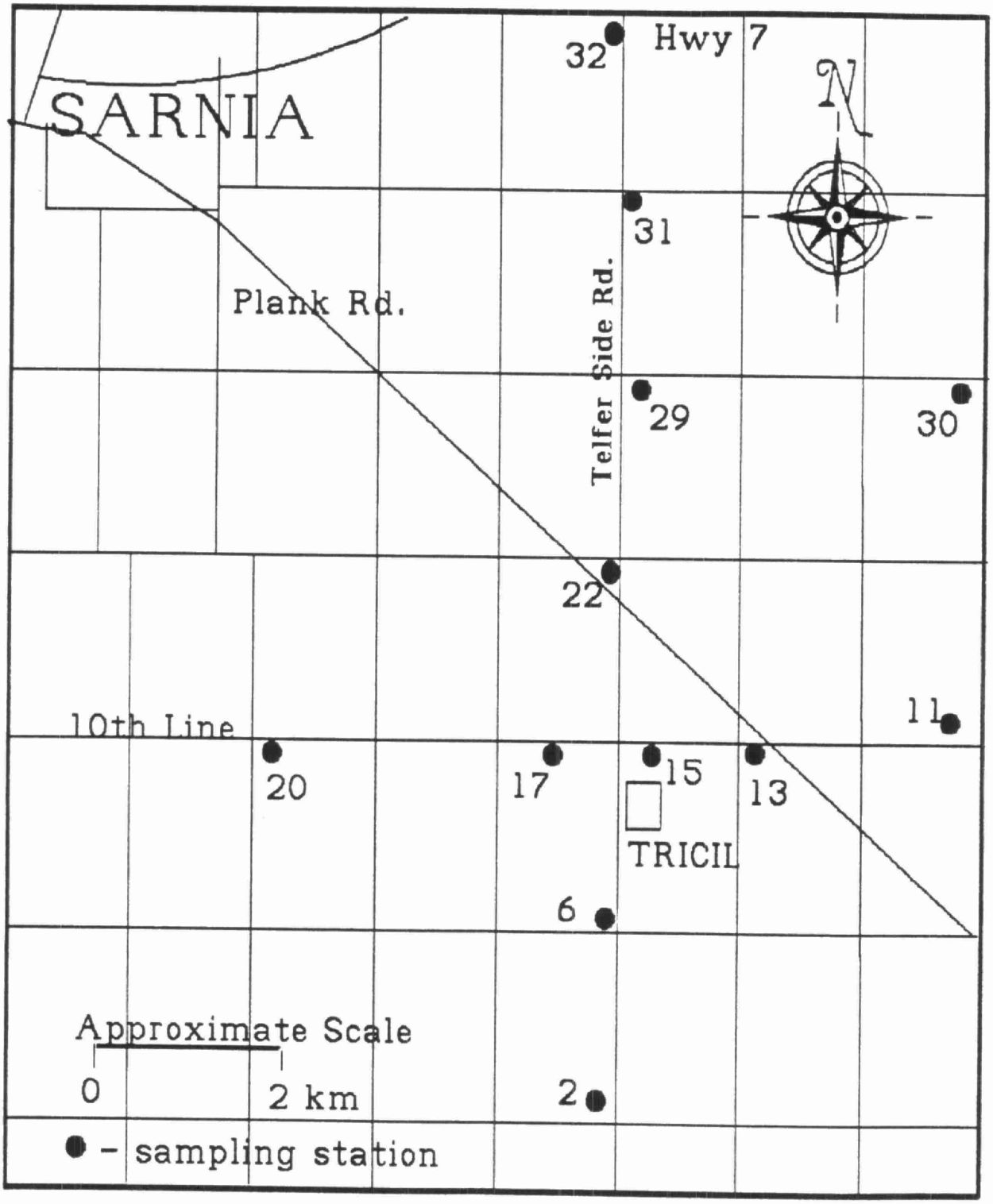
There has been considerable public concern about the company. Personnel of the Phytotoxicology Section have been involved in numerous complaints of vegetation damage reportedly caused by emissions from Tricil. To date only on one occasion has damage to vegetation been attributed to Tricil. This was the result of water runoff from the landfill site killing a number of trees immediately adjacent to the company (Harper 1985). In 1984 the Moore Township Council expressed concerned that the new higher smoke stack on the incinerator was causing emissions to be dispersed outside the area covered by the annual surveys. As a result four new stations were added to the survey farther downwind of the company.

## 2 METHODS

On August 8, 1987 Messrs. R.D. Jones and D.S. Harper of the Phytotoxicology Section sampled vegetation foliage at 12 sites within 8 km of the Tricil Ltd. plant near Corunna. The sampling stations were the same sites sampled since 1984. The locations of all the sampling sites are shown on the attached map (see Figure 1). At each site duplicate samples of silver maple foliage were collected for chemical analysis. The silver maple foliage and other native vegetation were examined at each sampling site for visible evidence of air pollution injury.

The samples were delivered to the Phytotoxicology Section vegetation processing laboratory in Toronto where they were dried and ground. The processed samples were submitted to the Ministry of Environment, Laboratory Services Branch, Inorganic Trace Contaminants Section for analysis for 15 elements. This list of elements included the same 15 elements analyzed for in 1986.

Figure 1: Map of the Vicinity of Tricil Ltd., Moore Twp. Showing the Location of Twelve Vegetation Sampling Stations Sampled in 1987.



## 3 RESULTS

The results of the silver maple foliage analysis for 1987 are given in Tables 1 and 2. The first table contains the results for the eight elements that have been analyzed for in silver maple foliage since 1977. The second table contains seven additional elements. Included in the tables are the respective Phytotoxicology Section Upper Limits of Normal concentration for tree foliage in rural areas for those elements that limits have been determined (see Appendix B for a description of the Upper Limits of Normal).

**Table 1:** Results of Analysis of Silver Maple Foliage Collected August 8, 1987 at Twelve Sites Near Tricil Ltd., Corunna

| Chemical Content of Silver Maple Foliage (ppm dry weight) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Station Number | Cadmium | Chromium | Copper | Iron | Lead | Nickel | Vanadium | Zinc |
| 2 | <0.1 | 2 | 4 | 105 | 2 | <1 | <1 | 17 |
| 6 | 0.1 | 3 | 7 | 170 | 2 | <1 | <1 | 31 |
| 11 | 0.2 | 1 | 5 | 265 | 3 | <1 | 1 | 33 |
| 13 | 0.2 | 2 | 6 | 200 | 2 | <1 | <1 | 34 |
| 15 | 0.2 | 4 | 6 | 225 | 5 | 1 | <1 | 39 |
| 17 | <0.1 | 2 | 6 | 185 | 2 | <1 | <1 | 40 |
| 20 | <0.1 | 2 | 7 | 130 | 2 | <1 | <1 | 22 |
| 22 | <0.1 | 2 | 9 | 150 | 2 | <1 | <1 | 36 |
| 29 | 0.2 | 1 | 6 | 120 | 1 | 1 | <1 | 31 |
| 30 | 0.1 | 1 | 5 | 175 | 2 | <1 | <1 | 26 |
| 31 | <0.1 | 1 | 6 | 140 | 2 | <1 | <1 | 38 |
| 32 Control | 0.1 | 1 | 5 | 140 | 3 | <1 | <1 | 23 |
| **U.L.N.** | **1.0** | **8** | **20** | **500** | **30** | **5** | **5** | **250** |

**U.L.N. - Upper Limits of Normal Concentration for Rural Tree Foliage**

**Table 2:** Results of Analysis of Silver Maple Foliage Collected August 8, 1987 at Twelve Sites Near Tricil Ltd., Corunna

| Chemical Content of Silver Maple Foliage (ppm dry weight) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Station Number | Calcium | Chloride | Fluoride | Magnesium | Molybdenum | Sodium | Sulphur |
| 2 | 11000 | 2900 | 5 | 3450 | <0.5 | 20 | 1400 |
| 6 | 10500 | 4050 | 6 | 2950 | <0.5 | 21 | 2200 |
| 11 | 11500 | 4600 | 6 | 2300 | <0.5 | 32 | 1900 |
| 13 | 22000 | 1200 | 7 | 4350 | <0.5 | 25 | 1800 |
| 15 | 9140 | 3300 | 7 | 2950 | 0.7 | 46 | 1600 |
| 17 | 8900 | 700 | 6 | 3050 | <0.5 | 19 | 1400 |
| 20 | 9500 | 1150 | 6 | 2950 | <0.5 | 16 | 1700 |
| 22 | 13000 | 1300 | 7 | 3150 | <0.5 | 25 | 1600 |
| 29 | 13500 | 3700 | 5 | 2950 | <0.5 | 15 | 1700 |
| 30 | 14000 | 3600 | 7 | 2950 | <0.5 | 72 | 1800 |
| 31 | 11000 | 950 | 7 | 2950 | <0.5 | 24 | 1400 |
| 32 Control | 15000 | 3300 | 6 | 3400 | <0.5 | 19 | 1700 |
| **U.L.N.** | **30000** | **1500** | **15** | **7000** | **1.5** | **50** | **4000** |

**U.L.N. - Upper Limits of Normal Concentration for Rural Tree Foliage**

## 4 DISCUSSION

With the exception of chloride the Upper Limits of Normal concentrations for rural vegetation were not exceeded for any element at any location. In the 1985 survey (R.D. Jones 1986) it had been reported that the Upper Limits of Normal for chloride had been exceeded at a number of locations. Since chloride in vegetation foliage is highly variable (between plant species) this Upper Limit of Normal is currently under review. Normal chloride concentrations in oak foliage are, for instance, in the range of 0.02 to 0.10% by weight. On the other hand species such as cabbage, chard and beet normally contain well over 1.0%, by weight. Silver maple appears, based on Phytotoxicology Section data, to be intermediate between these extremes. A species specific Upper Limit of Normal based only on silver maple, not influenced by road deicing salt applications, would probably be between 0.2 and 0.3%, by weight.

In this survey certain trees are so close to road allowances that road salting influences cannot be ruled out. There are, however, trees sampled that are well removed from roadways. Elevated chloride found in maple samples collected at sites 11 and 15 should not have resulted from uptake via salt contaminated soil. Conversely foliage from trees at sites 13, 17, and 22 all within the impact zone of Tricil emissions, contained relatively low, normal chloride concentrations. Consequently, without further changes to the sampling program, it is not possible to conclude whether or not airborne chloride emissions from Tricil have resulted in elevated chloride concentrations in silver maple foliage.

The low concentrations (below Upper Limits of Normal) and the narrow range of concentrations for all the elements, with the exception of chloride, make it difficult to determine if there is any pattern of contamination around the company. However, there appears to be a small area of slightly increased levels of iron and chromium centered around the company. The area of elevated concentrations varied with each element but tended to extend from around the company to the north east for two to three kilometers. There was a similar trend for the same two elements (plus sodium and zinc) in 1985 and 1986 (R.D. Jones 1987) but not in any of the other years. For all of the other elements no pattern of elevated levels was apparent.

It should be noted that these elevated levels were well within the Upper Limits of Normal for a rural location and were too small to scientifically determine whether they were the direct result of emissions from Tricil. However, the persistence of the pattern over three years would suggest that that the elevated levels may be the result of emissions from Tricil.

No visible evidence of air pollution injury, attributed to Tricil emissions, was observed on vegetation growing in the vicinity of Tricil. At numerous locations insect galls, leaf miner injury and other pest damage symptoms were observed on the silver maple.

## 5 SUMMARY

As with all previous Phytotoxicology assessment surveys the Upper Limits of Normal rural contaminant guidelines were only exceeded for chloride. However, as there was no pattern to the high levels of chloride the results did not appear to be related to emissions from Tricil. Analysis of vegetation for other possible inorganic contaminants revealed a pattern of slightly elevated concentrations of chromium and iron in samples near Tricil. The concentrations of these elements were only marginally above the background levels and in all cases were below the respective Upper Limits of Normal. This pattern is recent in nature first being observed in the 1985 survey results. At this time it is not possible to determine if the elevated levels are the result of emissions from Tricil. The only injury observed on the silver maple samples was attributed to insect pests.

## 6 REFERENCES


1. D.S. Harper, A report of a Phytotoxicology Section survey in the vicinity of Tricil Limited, Corunna on August 3-5, 1977., Ministry of Environment 1977.

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4. D.S. Harper, A report on the Phytotoxicology investigation of damage to vegetation in Lot 9, Concession 9, Moore Township, Ontario on August 21, 1985., ARB-163-85-Phyto, Ministry of Environment 1985.

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# 7 APPENDICES

## 7.1 Appendix A: Summary of Yearly Activities

Table 3: Yearly Summary of Survey Activities

| Year | Silver Maple | Grass | Soil | Stations Sampled |
|---|---|---|---|---|
| 1977 | X | | X | 30 |
| 1978 | X | X | X | 30 |
| 1979 | X | X | | 30 |
| 1981 | X | X | | 30 |
| 1982 | X | X | | 9 |
| 1983 | X | | | 8 |
| 1984 | X | | | 12 |
| 1985 | X | | | 12 |
| 1986 | X | | | 12 |
| 1987 | X | | | 12 |

## 7.2 Appendix B: Upper Limits of Normal

### Derivation and Significance of MOE "Upper Limits of Normal" Contaminant Guidelines

The MOE "upper limits of normal" contaminant guidelines essentially represent the expected maximum concentration of contaminants in surface soil (non-agricultural), foliage (tree and shrub), grass, moss bags and or snow from areas of Ontario not subject to the influence of point sources of emissions. "Urban" guidelines are based upon samples collected from centers of minimum 10,000 population. "Rural" guidelines are based upon samples collected from non-built-up areas. Samples were collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch: Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant levels in samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are non-normal, the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples.

Due to the large variability in element concentrations which may be present across Ontario, even in background data, control samples should always be collected. This is particularly important for soils, which may show large regional variations in element composition due to difference in parent material. Species of vegetation which naturally accumulate high levels of an element also may be encountered.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of the above normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines are not known to be toxic.